This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found here.

If you have a suggestion to make the keys better, please fill out the short survey here.

Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.

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1. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(2 - 6i)(-8 + 10i)$$

The solution is $44 + 68i$, which is option C.

A. $a \in [-80, -70]$ and $b \in [25, 31]$

$-76 + 28i$, which corresponds to adding a minus sign in the second term.

B. $a \in [36, 45]$ and $b \in [-70, -64]$

$44 - 68i$, which corresponds to adding a minus sign in both terms.

C. $a \in [36, 45]$ and $b \in [68, 73]$

* $44 + 68i$, which is the correct option.

D. $a \in [-16, -12]$ and $b \in [-65, -58]$

$-16 - 60i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

E. $a \in [-80, -70]$ and $b \in [-28, -23]$

$-76 - 28i$, which corresponds to adding a minus sign in the first term.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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2. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{3969}{49}}$$

The solution is Integer, which is option C.

A. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

B. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

C. Integer

* This is the correct option!

D. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

E. Irrational

These cannot be written as a fraction of Integers.

General Comment: First, you **NEED** to simplify the expression. This question simplifies to -63.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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3. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-5 + 7i)(6 - 8i)$$

The solution is $26 + 82i$, which is option C.

A. $a \in [-91, -85]$ and $b \in [-3, -1]$

$-86 - 2i$, which corresponds to adding a minus sign in the first term.

B. $a \in [-38, -26]$ and $b \in [-59, -54]$

$-30 - 56i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

C. $a \in [26, 29]$ and $b \in [79, 86]$

* $26 + 82i$, which is the correct option.

D. $a \in [-91, -85]$ and $b \in [2, 5]$

$-86 + 2i$, which corresponds to adding a minus sign in the second term.

E. $a \in [26, 29]$ and $b \in [-89, -79]$

$26 - 82i$, which corresponds to adding a minus sign in both terms.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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4. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-27 + 77i}{8 + 5i}$$

The solution is $1.90 + 8.44i$, which is option B.

A. $a \in [-5, -3]$ and $b \in [15, 16.5]$

$-3.38 + 15.40i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [1, 2.5]$ and $b \in [6, 9.5]$

* $1.90 + 8.44i$, which is the correct option.

C. $a \in [1, 2.5]$ and $b \in [750.5, 751.5]$

$1.90 + 751.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [-7, -6.5]$ and $b \in [4, 6.5]$

$-6.75 + 5.40i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [168.5, 170]$ and $b \in [6, 9.5]$

$169.00 + 8.44i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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5. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{72 + 55i}{4 + i}$$

The solution is $20.18 + 8.71i$, which is option B.

A. $a \in [342.5, 344]$ and $b \in [8, 10.5]$

$343.00 + 8.71i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [20, 21.5]$ and $b \in [8, 10.5]$

* $20.18 + 8.71i$, which is the correct option.

C. $a \in [20, 21.5]$ and $b \in [147.5, 149]$

$20.18 + 148.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [13, 14.5]$ and $b \in [15.5, 18]$

$13.71 + 17.18i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

E. $a \in [17, 18.5]$ and $b \in [54.5, 56]$

$18.00 + 55.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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6. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{81}{0}} + \sqrt{90}i$$

The solution is Not a Complex Number, which is option E.

A. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

B. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

C. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

D. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

E. Not a Complex Number

* This is the correct option!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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7. Simplify the expression below and choose the interval the simplification is contained within.

$$8 - 10 \div 20 * 13 - (6 * 7)$$

The solution is -40.500, which is option C.

A. $[-31.9, -28.9]$

-31.500, which corresponds to not distributing a negative correctly.

B. $[47, 50.8]$

49.962, which corresponds to not distributing addition and subtraction correctly.

C. $[-42.5, -38.3]$

* -40.500, which is the correct option.

D. $[-38.4, -32.8]$

-34.038, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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8. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{78400}{400}}$$

The solution is Integer, which is option A.

A. Integer

* This is the correct option!

B. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

C. Irrational

These cannot be written as a fraction of Integers.

D. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

E. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to -280.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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9. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{0}{361}} + \sqrt{5}i$$

The solution is Pure Imaginary, which is option D.

A. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

B. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

C. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

D. Pure Imaginary

* This is the correct option!

E. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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10. Simplify the expression below and choose the interval the simplification is contained within.

$$4 - 6 \div 1 * 16 - (8 * 11)$$

The solution is -180.000, which is option A.

A. $[-181, -178]$

* -180.000, which is the correct option.

B. $[-1101, -1097]$

-1100.000, which corresponds to not distributing a negative correctly.

C. $[87.62, 99.62]$

91.625, which corresponds to not distributing addition and subtraction correctly.

D. $[-86.38, -83.38]$

-84.375, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.
